# OV5 HOMOGENIZER

# WHAT IS DISPERSING?

The term "dispersing" means the **crushing** and **dispersing** of a solid, liquid or gaseous phase in a fluid with **which it cannot be totally mixed**.

- Dispersing is used to reduce the particle size of a material (crushing)
- Dispersing is also used to mix materials that are usually immiscible

# DISPERSING

## TERMS USED IN DISPERSING TECHNOLOGY

**SUSPENSION** - A coarse dispersing system of insoluble particles of solids in a liquid dispersion medium.

*Example*: X-ray contrast media, clay slurries, milk of lime, pharmaceutical preparations.

**EMULSION** - A thermodynamically unstable system consisting of at least 2 liquids which are normally immiscible, of which one is dispersed in spherules in the other liquid phase.

*Example*: lotions, creams, milk, soluble oil, margarine, mayonnaise.

**AEROSOL** - a dispersion of gas in liquid.

*Example*: Shaving foam

# VISCOSITY

One of the most important criteria when working with dispersers is the viscosity. Viscosity is a measure for the internal friction or flow resistance of a liquid.

As viscosity increases, the flow rate decreases. Generally, **for each 1000 mPas increase in viscosity, the flow-rate decreases by 20-25%.**

If the viscosity or flow limit is too high, the material does not flow, which might lead to a flow interruption in the rotor-stator system.

Some examples of viscosity for common substances at 20 °C, in mPas:

- Water: 1
- Ethyl Alcohol: 1.2
- 100% Glycerine: 1,500
- Honey: 10,000

**VELP OV5 is able to process viscosities up to 10'000 mPas**

# OV5 – ROTOR-STATOR PRINCIPLE

## HOW IS FLUID SHEAR INDUCED IN ROTOR/ STATOR?

- Rotor rotates on shaft axis enclosed in stator

- Fluid enters on the same axis as drive shaft

- Momentum is changed 90 degrees and moves in radial direction due to centrifugal force

- Fluid enters channel between rotor teeth subjected to centrifugal thrust



A view "inside"

gap
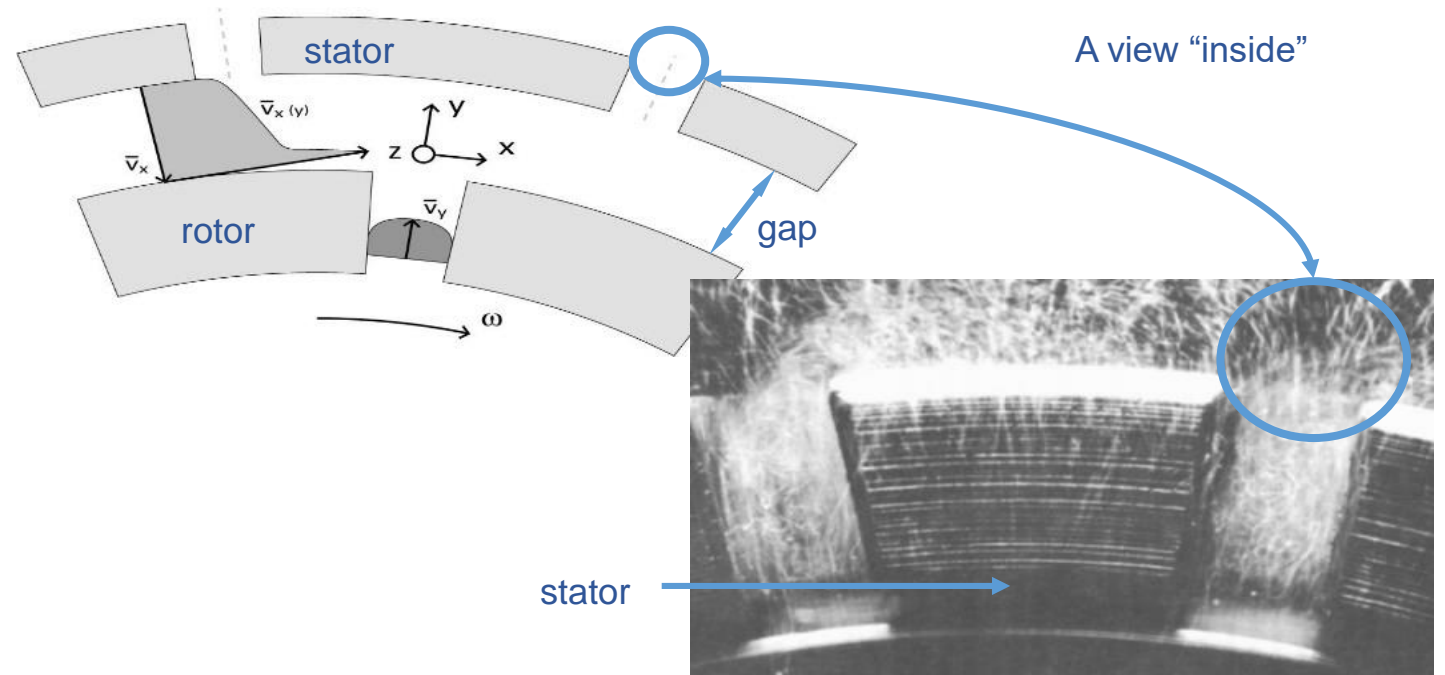
stator

# OV5 – ROTOR-STATOR PRINCIPLE

The dispersing head or generator consists of a rotor which rotates at high speed within a stationary stator.

The rotor and the stator have one or more rows of sharp-edged "**teeth**".

Because of the high rotor speed, the medium to be processed is **automatically sucked axially into the dispersing head and is then pressed radially through the slots of the rotor-stator arrangement**.
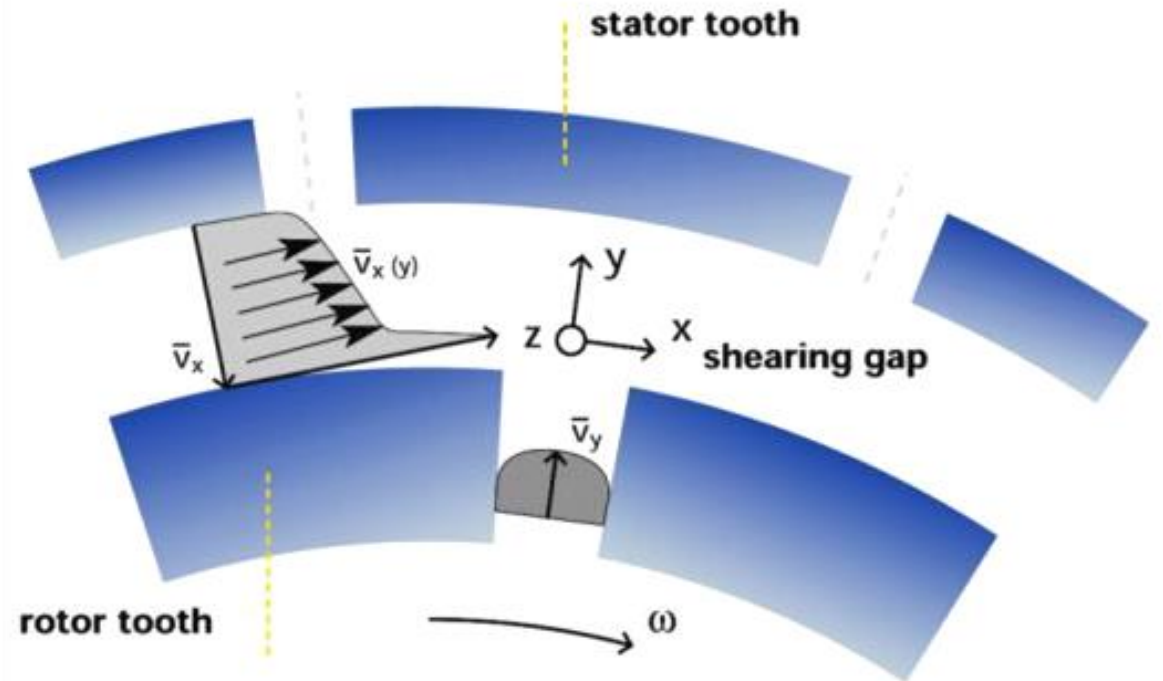
Stator

Shear gap
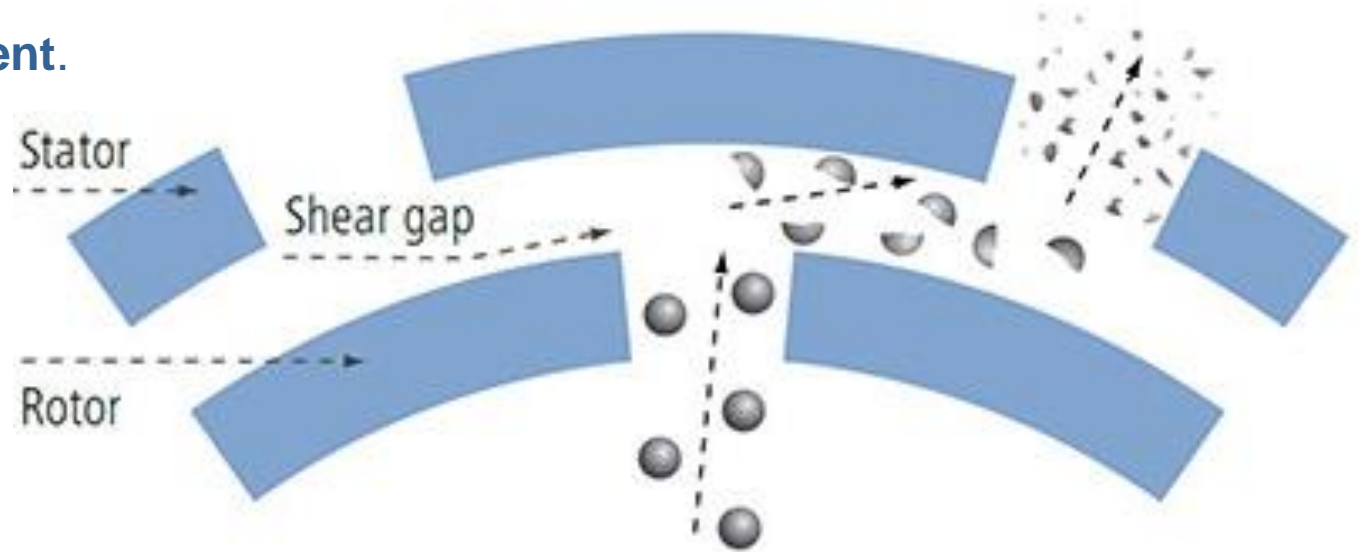
Rotor

# OV5 – ROTOR-STATOR PRINCIPLE

Due to the great forces of acceleration, the material is subjected to **very high shearing** and **thrusting forces**, causing the reduction of the particle size.

The additional high turbulence occurring in the **shearing gap between the rotor and the stator leads to an intensive mixing of the material.**

Dispersers are also referred to as "high shear" machines.

# OV5 - SHEARING FORCE

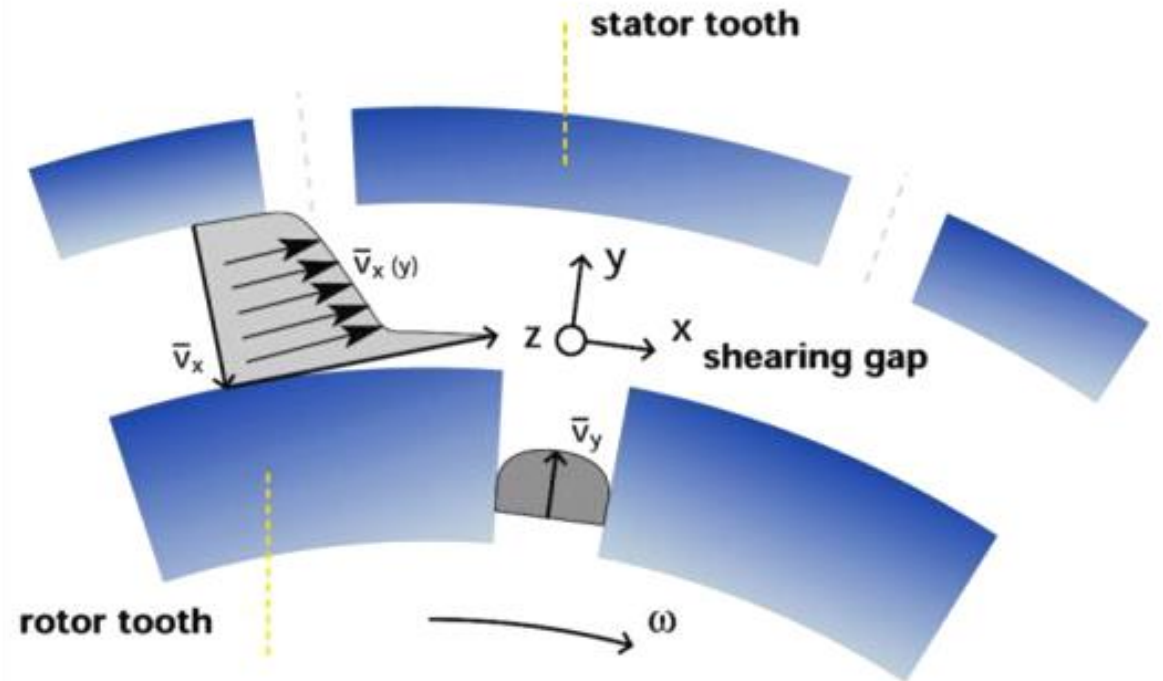The Shearing force is calculated using the following formula:

$$\text{Shear force} = \frac{\text{Peripheral speed}}{\text{Clearance}}$$

- Peripheral speed is the **speed of the rotor**
- Clearance is the **distance between rotor and stator**. (Usually between 0,3 mm and 1 mm)

For best results, the peripheral speed should be aximised and the clearance minimised.

**Shear in Inversely proportional to Viscosity**

# OV5 – ROTOR-STATOR PRINCIPLE

## HOW IS FLUID SHEAR INDUCED IN ROTOR/ STATOR?

- A **small portion/parcel** is allowed to enter into the gap (rotor-stator space) before original stream is cut off by the turning rotor. The fluid stream is reduced or braked as the fluid stream "sees" an alternative opening or closing on rotor.

- In the gap, fluid is subjected to **intense 3-dimensional shear** especially at the edge of the rotor teeth. Acceleration and braking - due to presence of teeth and slots.

- Combination of influence from gradient impulse results in shear frequency, shear rate and turbulence



A view "inside"

gap

stator
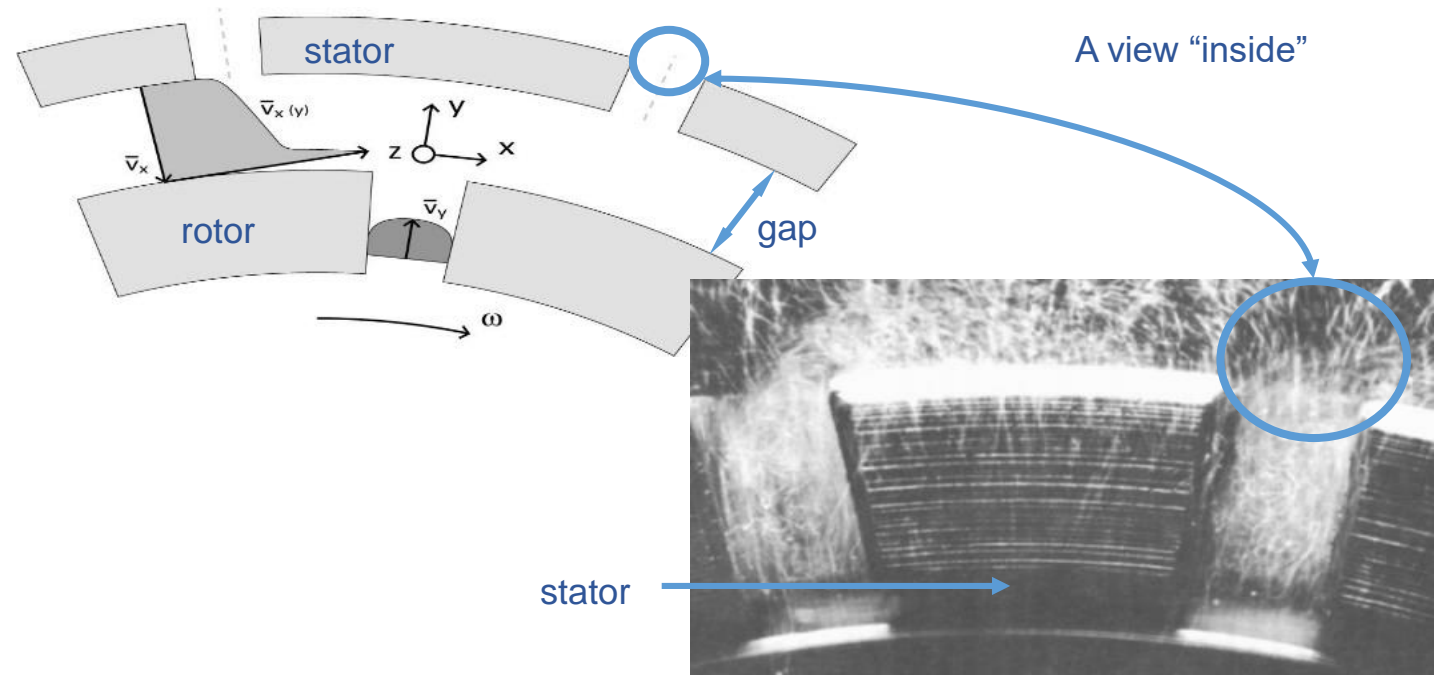
# SHEARING FORCE

**PERIPHERAL SPEED**

| | |
|---|---|
| Stirrer | 0 - 10 m/s |
| Disperser | 10 - 24 m/s |

**CLEARANCE**

Stirrer          0.250 m
(distance from propeller to the vessel wall)
Disperser       0.005 m

**SHEAR FORCE**

Stirrer          0-40
Disperser       2000 - 4800

# SHEARING FORCE

**DISPERSER vs STIRRER**

Therefore in the shearing gap of the disperser, its produced about **1000 times the energy is introduced into the medium than when processing by stirring**.

Dispersing times of a few minutes, or even a few seconds, are usually sufficient.

The short processing times is a key factor for not increasing the temperature of the medium due to the energy input (eg. RNA etc..)

# OV5 – ROTOR-STATOR PRINCIPLE

**BENEFITS**

- Time savings
- Energy savings
- Reduction in requirements for additives, stabilizers, emulsifiers

One of the most important parameters for selecting the appropriate instrument is the **volume** to be processed.

When selecting an instrument the focus has to be on volume and application

**OV5 VOLUMES**

- Up to 8 liters as homogenizer
- up to 40 liters as high speed mixer

# OV5 – ROTOR-STATOR PRINCIPLE

**QUESTION TO ASK**

- What is the initial size of the material to be dispersed?
- What is the ultimate fineness required ?
- If the material which is to be dispersed is initially coarse (8-20 mm), it is useful to work with two dispersing tools with different ultimate fineness.

**Important !!**
**Dry running destroys the seal**

# APPLICATIONS

**BIOCHEMISTRY**

- Disruption of animal and human tissues, e.g. from eukaryotic cell lines (human/rat/mouse) for 2D gel electrophoresis of cell lysates, enzyme studies, lipid and protein extraction.

- Fragmentation and disruption of muscle and other (vertebrate) tissues (human brain, lymph node, lung and skin); analysis of brain tissue.

- Sample preparation for RNA and DNA extraction; preparation of cell lysates and plasma proteins in vivo

# APPLICATIONS

## MEDICAL

- Sample preparation of cell dispersion for measurement of all intracellular glutathione from cultured kidney tubule cells;
- Examination of carcinomas from biopsies in cancer research;
- Homogenizing heart, liver, and skeletal tissues down to the subcellular level in the field of experimental surgery.

# APPLICATIONS

**PHARMACEUTICAL**

- Organ extracts
- Tablet / pill coatings
- Serum production
- Herbal extracts
- Gels
- Grinding pills for determination of
- Ointment production
- Color design of end product.

# APPLICATIONS

## COSMETICS INDUSTRY

- Making emulsions from oil and water
- Productions of lotions
- Hair carearticles
- Bath salts
- Sun tan lotions
- Deodorants, gels, nail varnishes lip sticks
- Natural cosmetics,
- Mascara
- Shaving cosmetics
- Tooth paste
- Showering additives, hair dyes, plant extracts, shampoo, skin oils.

# APPLICATIONS

## FOOD AND FEED INDUSTRY

- Enzymatic treatment
- Preparation of concentrates
- Mixing of beverages
- Stabilizers
- Charging with sugar (e.g. glucose and fructose)
- Milk processing
- Baby food
- Ketchup
- Dietary food
- Feed
- Blending of coloring matter and flavors



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# APPLICATIONS

**CHEMICAL INDUSTRY - PETROCHEMISTRY**

- Adding lubrication / lube oil additives
- Sample preparation for determining the water content of crude oil(s)
- Analyzing aging of lubricating oils according to DIN (resistance to oxidation)
- Laboratory-scale mineral and lubricating oil production,
- Production of coated paper, e.g. in the food industry / sector,
- Bitumen for road construction, synthetic bonding agents for making colored asphalts, color coatings or colored isolations.

**PAINT AND LACQUER INDUSTRY**

- Production of printing links
- Latex and emulsion paint
- Impregnating agents for wood, loading (with) pigments, disintegrating thixotropic materials /matter
- Finest grade homogenizing of water lacquers
- Metal lacquers

# OV5 - BENEFITS

- All dispersing tools can be used with the same drive
- Any **rotor/stator can be exchanged** thus no requirement to buy one complete shaft for each application. You buy what really is needed
- **Easy dismantling** and **assembly** of **shafts** for sterilizing purpose without special tools within a few seconds
- High rpm rates of **10000-30000 rpm**, very high tip speeds result in shorter processing time and finer particle sizes
- Safety switch protects the operator
- Jerk free start and constant rpm rates
- Excellent price/performance ratio

VELP high quality Analytical Dept. at your disposal for fine tuning your application

# OV5 - BENEFITS

## GENERAL FEATURES

| | |
|---|---|
| Construction material: | Technopolymer |

Very fast assembly and disassembly system for dispersing tools

| | |
|---|---|
| Power: | 500 W |
| Weight: | 1.3 Kg (2.9 lb) |
| Dimensions (WxHxD): | 70x255x70 mm (2.7x10x2.7 in) |

## PERFORMANCE

| | |
|---|---|
| Stirring speed: | from 10'000 to 30'000 rpm |
| Stirring speed: | graduated scale |
| Stirring volume max (H2O): | up to 8 liters as homogenizer |
| Stirring volume max (H2O): | up to 40 liters as high speed mixer |
| Max viscosity (mPa*s)*: | 10'000 |

# OV5 ACCESSORIES

**A00000045**

H-stand with strap clamp, bosshead clamp

With this single code is possible to get all the necessary tools for supporting the OV5

**A00001300**

Support rod and base

**A00001300**

Double Clamp

**A00000044**

Strap clamp

**A00000279**

Stator rotor release kit

**This accessories combined together allow a second configuration for OV5 support.**

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# OV5



Homogenizer
OV5
R20900010

Shaft
VS
A00000047

Stators

VS2C
A00000048

VS2F
A00000049

VS3C
A00000050

VS3F
A00000051

VS4C
A00000052

Rotors

VSR2
A00000053

VCR2
A00000054

VMR2
A00000055

Rotors

VSR3
A00000057

VCR3
A00000058

VMR3
A00000059

VMR2
A00000055

Rotor

VMR3
A00000059

Rotors

VER2
A00000056

VSR2
A00000053

VCR2
A00000054

VMR2
A00000055

Rotors

VER3
A00000060

VSR3
A00000057

VCR3
A00000058

VMR3
A00000059

# OV5 – DISPERSING TOOLS

**A00000026 – VSS2CSR2**
Dispersing Tool for solid/liquid

**Applications:**
Ceramic Industry – Pharmaceutical Industry –
Petrochemical Industry Sewage Pollution Control

**A00000029 – VSS2FER2**
Dispersing Tool for water, oil, or oil/water emulsions

**Applications:**
Paper and Tissue – Pharmaceutical Industry – Sewage
pollution control- Paint Industry

**A00000027 – VSS2CCR2**
Dispersing Tool with blades for fibrous/stringy materials

**Applications:**
Ceramic Industry – Pharmaceutical Industry –
Petrochemical Industry Sewage Pollution Control

**A00000031 – VSS2FCR2**
Dispersing Tool with blades for fibrous/stringy materials

**Applications:**
Biotechnology – Paper & Tissue – Food Industry –
Tobacco Industry – Medical – Sewage pollution Control

**A00000028 – VSS2CMR2**
Dispersing Tool for solid/liquid

**Applications:**
Ceramic Industry – Paint Industry

**A00000032 – VSS2FER2**
Dispersing Tool solid/liquid media

**Applications:**
Ceramic Industry – Paper & Tissue – Food Industry –
Cosmetic – Petrochemical – Paint Industry

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# OV5 – DISPERSING TOOLS

**A00000033 – VSS3CSR3**
Dispersing Tool solid/liquid media

**Applications:**
Paper & Tissue – Food Industry – Pharmaceutical – Medical – Sewage pollution Control

**A00000036 – VSS3CMR2**
Stirring shaft

**Applications:**
Ceramic – Food Industry –Sewage pollution Control

**A00000034 – VSS3CCR3**
Dispersing Tool with blades for fibrous/stringy materials

**Applications:**
Paper & Tissue – Food Industry – Pharmaceutical – Medical – Sewage pollution Control

**A00000037 – VSS3FER3**
Dispersing Tool for water/oil or water/oil emulsions

**Applications:**
Paper & Tissue – Pharma – Sewage Pollution Control – Paint Industry

**A00000035 – VSS3CMR3**
Dispersing Tool solid/liquid media

**Applications:**
Ceramic Industry – Paint industry

**A00000038 – VSS3FSR3**
Dispersing Tool for solid/liquid media

**Applications:**
Paper & Tissue – Pharma – Sewage Pollution Control – Paint Industry

# OV5 – DISPERSING TOOLS

**A00000040 – VSS3FMR3**
Dispersing Tool for solid/liquid media

**Applications:**
Ceramic Industry – Food Industry – Cosmetic – Pharma – Tobacco

**A00000041 – VSS4CMR3**
Stirring shaft

**Applications:**
Ceramic Industry – Food Industry – Sewage pollution control

**A00000046 – VSS5CSR4**
Dispersing Tool for solid/liquid media

**Applications:**
Biotechnology – Medical

# OV5 – DISPERSING TOOLS

## AVAILABLE CONFIGURATIONS

| MODEL | CODE NO | APPLICATION FIELD*** | FUNCTION +++ | TREATABLE VOLUME (WATER) ml | MAX. CIRCUM. SPEED m/s | Ø ROTOR mm | Ø STATOR mm | TOOL LENGHT mm | MIN/MAX IMMERSION DEPTH mm | ULTIMATE FINENESS µm SUSPENSION | ULTIMATE FINENESS µm EMULSION |
|---|---|---|---|---|---|---|---|---|---|---|---|
| *VSS2CSR2 | A00000026 | CE,IF,PC,SI | A | 100-5000 | 22,7 | 15 | 20 | 220 | 40/175 | 10 - 50 | 1- 10 |
| VSS2CCR2 | A00000027 | CT,IA,IT,M,SI | B | 100-5000 | 22,7 | 15 | 20 | 220 | 40/175 | 10 - 50 | 1- 10 |
| VSS2CMR2 | A00000028 | CE,VE | A | 100-5000 | 22,7 | 15 | 20 | 220 | 40/175 | 10 - 50 | 1- 10 |
| *VSS2FER2 | A00000029 | CT,IF,SI,VE | C | 100-5000 | 22,7 | 15 | 20 | 220 | 40/175 | 10 - 50 | 1- 10 |
| VSS2FCR2 | A00000031 | BT,CT,IA,IT,M,SI | B | 100-5000 | 22,7 | 15 | 20 | 220 | 40/175 | 10 - 50 | 1- 10 |
| VSS2FMR2 | A00000032 | CE,CT,IA,IC,PC,VE | A | 100-5000 | 22,7 | 15 | 20 | 220 | 40/175 | 10 - 50 | 1- 10 |
| *VSS3CSR3 | A00000033 | CT,IA,IF,M,SI | A | 100-8000 | 34,9 | 23 | 30 | 220 | 40/175 | 5 - 25 | 1- 5 |
| VSS3CCR3 | A00000034 | CT,IA,IF,M,SI | B | 100-8000 | 34,9 | 23 | 30 | 220 | 40/175 | 5 - 25 | 1- 5 |
| VSS3CMR3 | A00000035 | CE,VE | A | 100-8000 | 34,9 | 23 | 30 | 220 | 40/175 | 5 - 25 | 1- 5 |
| VSS3CMR2 | A00000036 | CE,IA,SI | D | 250-20000 | 34,9 | 15 | 30 | 220 | 40/175 | High speed mixer | |
| *VSS3FER3 | A00000037 | CT,IF,SI,VE | C | 100-8000 | 34,9 | 23 | 30 | 220 | 40/175 | 5 - 25 | 1- 5 |
| VSS3FSR3 | A00000038 | CT,IF,SI,VE | A | 100-8000 | 34,9 | 23 | 30 | 220 | 40/175 | 5 - 25 | 1- 5 |
| VSS3FMR3 | A00000040 | CE,IA,IC,IF,IT | A | 100-8000 | 34,9 | 23 | 30 | 220 | 40/175 | 5 - 25 | 1- 5 |
| *VSS4CMR3 | A00000041 | CE,IA,SI | D | 1000-40000 | 34,9 | 23 | 40 | 220 | 40/175 | High speed mixer | |
| **VSS5CSR4 | A00000046 | BT,M | A | 0,2-50 | 6,3 | 4 | 5 | 128 | 10/60 | 10 - 50 | 1- 10 |

\*    Most used model
\*\*   The dispersing tool works with Ø 4 mm rotor and Ø 5 mm stator for microbiological applications (e.g. suitable for Eppendorf, cuvettes,etc.)
\*\*\*  BT = biotechnology, CE = ceramic industry, CT = paper & tissue industry, IA = food industry, IC = cosmetic industry, IF = pharmaceutical industry, IT = tobacco industry, M = medicine, PC = petrochemistry industry, SI = sewage pollution control, VE = paint industry
\*\*\*\* A = dispersing tool for solid/liquid media, B = dispersing tool with blades for fibrous/stringy materials, C = dispersing tool for water/oil or oil/water emulsions, D = stirring shaft